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DYNAMIC FOREIGN POLICY INTERACTIONS:
SOME IMPLICATIONS FOR A NON-DYADIC
WORLD

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<p>In this paper the attempt is made to develop a more formal theoretical approach to the study of the effects of third parties on the dyadic interactions of nations. A fully formalized general theory is presented and some of the predictions which it generates are tested. Particular attention is paid to the impact of saliency on the shaping of an actor's foreign policy in the context of dyadic and triadic consistency considerations. The findings reveal that third party activity does have an impact on dyadic relationships and that its impact is generally conditioned by the saliency of the third party to the actor involved. Thus, both third party activity and saliency are shown to be important considerations in the attempt to specify the decision making rules which nations use in dealing with other nations. Moreover, this paper demonstrates the utility of developing formal models to achieve this end in the context of the growing difficulties associated with the application of statistical methods to such endeavors.</p>			

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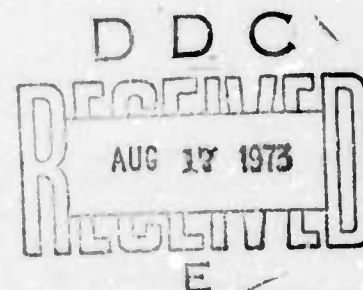
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"Dynamic Foreign Policy Interactions:
Some Implications for a Non-Dyadic World"

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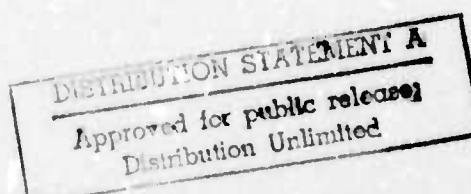
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This paper is part of a continuing effort to produce a general theory of foreign policy activity. We hope to increase our understanding of foreign policy decisions by being able to explain the pattern of interactions between nations. We assume that the interactions between two nations are embedded in a larger environment consisting of other nations and the interactions among them. In this paper the effort will be advanced by articulating a fully formalized general theory, giving it an interpretation and testing some of the predictions which it generates.

The essential building block of our theory is the interaction paradigm. This approach to international politics has a long and venerable tradition in the literature. Its baptism into scientific literature was initiated by Charles McClelland. He suggested that once the relations that make up international politics were broken down into their most elementary form they take on the basic pattern of figure 1. It shows that the facts of international relations can be selected and organized according to the two references of actors and interactions (McClelland, 1966, p. 18). Other theorists have underscored the importance of considering the total interactions in a dyad when explaining foreign policy behavior, especially when the nations comprising the dyad are antagonistic (Burton, 1968; North, et. al., 1968; Zinnes, 1968). This literature suggests that the behavior of one nation acting towards another (the object) is in large part dependent on the behavior of the object to the actor. It is not especially daring to suggest that

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behavior begets behavior. We simply expect that nations will generally act much like individuals in the sense that there is a strong tendency to return behaviors similar to those received. Nations are assumed not to be acting in a vacuum but in a real world in which interaction is a reality. A nation, as an actor in the nation-state system, will largely base the nature of its interaction with the second nation (object) on the nature of the last or last several actions of that object nation toward the actor. Tests of these concerns (Phillips, 1971, 1972) have tended to provide support for this assertion. Other works in international relations (Tanter, 1972; Bartos, 1966; Azar, 1970) suggest similar hypotheses.

But international politics must surely be more than a tennis match in which each actor's response is to the object's service. The outer environment of the nation contains many nations, the behavior of each having potential implications for the capacity of the decision-makers of the nation to devise policy which can achieve national goals. These third parties have an impact on the interactions of the dyadic pair both by creating contradictions in policy actions and by diverting the attention of decision-makers from the pattern of interactions in the dyad. For instance, the fact that two nations are engaged in armed conflict will narrow the range of alternatives of other nations who choose to interact with either of the conflicting parties. An ally of the nation which is attacked feels pressure to punish the aggressor, both by increasing the conflict the aggressor experiences and by decreasing the cooperation it receives.

An analysis of the interactions among the United States, the Soviet Union and the People's Republic of China has shown clear empirical justification for the belief that third parties have an impact on dyadic interaction patterns (Phillips and Hainline, 1972). It was found there that Chinese actions towards the United States or the Soviet Union were quite sensitive to the exchanges between the United States and the Soviet Union. This paper will attempt to go beyond that effort to develop a theory of the effect of third parties upon dyadic interactions.

In order to build our theory we have found it necessary to make the following four assumptions:

1. Foreign policy can be conceptualized as a series of decisions made by national officials. Foreign policy activity consists of discrete behaviors representing the outcome of these decisions.
2. Foreign policy can be operationalized as the aggregation of the foreign policy activity (behaviors) according to some logic imposed upon them by the actor or observer.
3. The behavior of one actor towards another (foreign policy) is responsive to the actions of other nations and involves efforts to influence who will be the leaders of those nations, what decisions they will make, and how they will define the relations between their nation and others.
4. Foreign policy is made in a multination environment by decision-makers who have to cope with domestic constraints and who have mixed desires. Their activity is essentially a process of adaptation to the external and internal environment which they seek to coordinate in an effort to maintain autonomy and national sovereignty while pursuing positive goals in the international system.

These assumptions require that our theory begin with some decision-making premises and that when it comes to the

interfacing of theory and data that the data represent highly disaggregated measures of behavior so that the logic of decision can be examined empirically. Therefore, we use international events data as our data base.

We turn now to the problem of building the theory. The first step is to specify the language in which the theory can be embedded. The language we have chosen to use consists of a vocabulary of four elements; three variables and one operation defined on those variables, and a grammar, namely, vector algebra.

The first element in the vocabulary is a variable. It is a set of entities active in international politics. We call this set Y . Formally, this can be represented as¹

$$Y = \{ y_1, y_2, y_3, \dots, y_n \}$$

where each y_i represents a discrete entity in the international system. In our development we shall confine our attention to those entities which are nation-states. The analysis could perhaps fruitfully be extended to include international organizations of both the intergovernmental and nongovernmental varieties and multinational corporations.

The second element in the vocabulary is also a variable. It is a set of categories of behavior which may be directed from one member of Y to another. We call this set A . Formally

$$A = \{ a_1, a_2, a_3, \dots, a_m \}$$

Examples of such sets are quite important in the international relations literature. Each set is a categorization scheme allowing one to measure foreign policy output. One example of such a

set would be the dichotomy between the cooperation and conflict. Another would be the 63 categories in the World Event/Interaction Scheme devised by McClelland.

The third element in the vocabulary is a set of time periods. We shall call this variable T . This variable can be stated formally

$$T = \{t, t+1, t+2, \dots, t+q\}$$

In this research we shall assume that each element in T is a fairly long period of time, and that the time is measured in clock time.² An implication of this assumption is that time is constant across all terms in most of our equations. Therefore, in the equations the time subscript has not been explicitly stated but has been assumed to be equal on all terms in the equations. In those few equations where it is not possible to assume the same time for all terms the time subscripts have been explicitly provided.

In addition, it should be noted that if shorter periods of time were employed in building the theory or if some conception of social time were employed to measure time (for example, the number of days since a nation y_i was the target of action from some other nation y_j), then the formulation of the theory would be drastically different. Time subscripts would have to be explicitly stated for all terms for all equations, and the language of the theory would have to be some dynamic system such as differential or difference equations. Therefore, the choice of time measurement is crucial and should be kept in mind in evaluating the theory.

Employing these three elements, we can define a three dimensional space. The space is the product set of the elements of Y times the elements of Y times the elements of A at any time t , where in one case the elements in Y are taken to be the initiators of action and in the other case are the recipients of action. We call this space X . Formally,

Definition 1: $X = Y \times Y \times A$

An example of this space is illustrated in figure 2. The dimensions of the space are as follows:

length = n columns representing the n elements in Y
in their capacities as actors
height = n rows representing the n elements in Y
in their capacities as targets
width = m columns representing the m categories of
behavior in A

The fourth element in the vocabulary is an operation which sums the number of discrete instances of behavior category a_k in A directed toward any entity y_j in Y by any other entity y_i in Y . This operation fills the cells in X with integers.

We can now use this information to define a set of concepts which we will need in developing the theory. The first of these can be stated formally as:

Definition 2: $x_{ijk} = \{x: x \in X, x = y_i, y_j, a_k\}$

In other words, Definition 2 states that x_{ijk} represents the behavior of entity i to entity j in behavior category k . As an example, the idea of the threatening behavior of the U. A. R. toward Israel would be an interpretation of this abstract concept.

The formal statement of the second of these concepts is:

Definition 3: $\langle x_{ij} \rangle = \{x_{ij1}, x_{ij2}, \dots, x_{ijm}\}$

In English this definition states that the vector x_{ij} represents the behavior of entity i to entity j in all behavior categories of A . An example of a substantive interpretation of this idea would be the U. A. R.'s foreign policy behavior toward Israel in a given time period.

The last of the concepts to be introduced here can be stated formally as follows:

Definition 4: $X_i = \{\langle x_{i1} \rangle, \langle x_{i2} \rangle, \dots, \langle x_{in} \rangle\}$

Put another way, X_i is a matrix created by the set of vectors defined in Definition 3 above. The matrix has n rows and m columns defined by the n targets and m behavior categories respectively which a nation can choose in initiating a foreign policy act. This matrix is synonymous with the idea expressed in such phrases as the "foreign policy of Egypt". It should be noted in passing that the space X has an interpretation in the language of traditional political science writings. It is the

international system.

We turn now to the discussion of the substantive implications of characterizing the international system and foreign policy in this way. Operating from a decision-making perspective, we posit the following axiom and its corollaries:

Axiom 1: The foreign policy behavior of a nation y_i is the result of conscious decisions made by the decision makers in y_i .

Corollary 1.1: The nature of x_{ijk} is the result of conscious decisions made by the decision-makers of y_i .

Corollary 1.2: The nature of x_{ij} is the result of conscious decisions made by the decision-makers of y_i .

Corollary 1.2: The nature of x_i is the result of conscious decisions made by the decision-makers of y_i .

This is a fairly noncontroversial set of statements about the nature of foreign policy. The second axiom to be introduced is not so uncontroversial. It draws on an intuition related to one of the initial assumptions stated in the first part of the paper, that foreign policy is a goal-seeking activity. If this is so then one would expect decision-makers to control the stream

of outputs so that actions do not mitigate against the effects of other actions. This can be stated formally in the following axiom:

Axiom 2: The decision-makers in y_i seek to coordinate policy such that no x_{ijk} contradicts any other x_{ijk+1} in $\langle x_{ij} \rangle$ and each $\langle x_{ij} \rangle$ with each other $\langle x_{ij+1} \rangle$ in x_i so that there are no contradictions.

Note that this axiom does not say that the decision-makers are successful in this coordination effort. Indeed, it may be the case that many contradictions exist. In fact, one of the main thrusts of this paper is that it is impossible to avoid contradictions. But this does not deny the a priori validity of this axiom. It merely states that in the real world with multiple complexities, inadequate communications, memory failures and limited attention spans on the part of decision-makers, it is the tendency of decision-makers to avoid contradictions when they are able to discover them.

In order to make this pair of assertions falsifiable and therefore scientific, we must first make more explicit the sorts of decision-rules we expect decision-makers to follow in formulating foreign policy. And before this can be done we find it necessary to provide more information concerning the nature of the elements in the set A of categories of foreign policy behavior. Our strategy in this will be to define two

subsets of behaviors in A , cooperation and conflict. We will then posit a mathematical function which will reduce all the information in x_{ij} to two scalars, one of which measures the amount of cooperation and the other the amount of conflict. We will then provide a means for examining the balance of cooperation and conflict in a dyad and move from there to the concept of dyadic inconsistency. This concept will give us a handle on analyzing the nature of coherence and contradiction in foreign policy, which is where we want to get right now.

One of the basic distinctions in the analysis of foreign policy is that between cooperative and conflictual behaviors. We propose to employ the same distinction. Cooperation is understood to be those behaviors which are desired by and, therefore, rewarding to the target. Conflict is understood to be those behaviors which are undesired by and, therefore, punishing to the target. These distinctions can be introduced formally into the theory by means of the following definition:

Definition 5: $A = C \cup F$

where $C \subset A$, $F \subset A$

C is the subset of behaviors which can be identified as cooperative

F is the subset of behaviors which can be identified as conflictual

$$\phi = C \cup F$$

In other words, cooperation and conflict make up mutually exclusive and exhaustive subsets of the set of behaviors A

Because of this definition we must make a series of necessary changes in the notation used to identify the dyadic behavior of a nation. The next definition provides these changes.

Definition 6: $\langle x_{ij} \rangle = \langle c_{ij} \rangle \cup \langle f_{ij} \rangle$ where

$$\langle c_{ij} \rangle = \{ \langle x_{ij1}, \dots, x_{ijk} \rangle : x_k \in C \}$$

$$\langle f_{ij} \rangle = \{ \langle x_{ijk+1}, \dots, x_{ijm} \rangle : x_m \in F \}$$

Or, cooperation and conflict are mutually exclusive and exhaustive subsets of the behavior of nation y_i to nation y_j , that is, $\langle x_{ij} \rangle$.

Given this information it is possible to posit the existence of a function on each subset which will reduce the information in each to a scalar (a single number). Axiom 3 provides us with that.

$$\begin{aligned} \text{Axiom 3: } C_{ij}^* &= \langle \gamma_{ij} \rangle_{1 \times k} \cdot \langle c_{ij} \rangle_{k \times 1} \\ F_{ij}^* &= \langle \lambda_{ij} \rangle_{1 \times k} \cdot \langle f_{ij} \rangle_{k \times 1} \end{aligned}$$

What this axiom says is that we take the inner product of a vector of behaviors and a set of weights,

This linear

operation has the effect of creating a weighted scale to measure conflict or cooperation, by reducing the vectors to scalars.

(For a simple explanation of the mathematics involved in these operations, see Davis, 1965, pp. 32-38.) Notice, too, the substantive implications introduced. The vectors of weights, γ and λ , provide the perceptual grids by which national decision makers evaluate foreign policy behaviors. The fact that each vector is subscripted with both the actor and the object, e.g., C_{ij} , indicates that we are not imposing a requirement for a uniform

grid for all nations in all dyadic situations. Rather, we allow each set of decision-makers to bring a different perceptual grid to each dyadic relationship.

Now we would like to further reduce the information about the behaviors in x_{ij} . We would like to combine for each directed dyad the values of C_{ij}^* and F_{ij}^* so that a single value will result. We want the function that does this to provide us with an interval scale measurement. If it does this, it will tell us the balance of cooperation and conflict in a dyad as perceived by the actor nation. We believe the following function meets these criteria.

$$\text{Axiom 4: } X_{ij}^* = C_{ij}^* - F_{ij}^*$$

The preceding exposition has been made the way that it has for the purposes of substantive clarity. Within the grammar of matrix algebra the same result can be achieved in a much simpler manner. This would be to make super matrices of γ and λ on the one side and C_{ij} and F_{ij} on the other. By creating a super-matrix is meant that one vector is hooked onto the end of the other, creating a new vector. We now do this, making one additional necessary assumption.

$$\text{Axiom 4}^*: X_{ij}^* = \langle \pi_{ij} \rangle_{1 \times m} \cdot \langle R_{ij} \rangle'_{m \times 1}$$

where π_{ij} = a supermatrix created by the concatenation of $\langle \gamma_{ij} \rangle$ and $\langle \lambda_{ij} \rangle$

R_{ij} = a supermatrix created by the concatenation of $\langle c_{ij} \rangle$ and $\langle f_{ij} \rangle$ and all the elements in $\langle \lambda_{ij} \rangle$ are assumed to have a negative value, that is, to provide a negative weight.

dyad relationships and to minimize the weak ones. In other words, decision makers strive for consistency in interaction patterns.

This rule can be stated in the axiom:

Axiom 5: The decision makers in nation y_i choose foreign policy actions according to the following rule: $\min (A_{ij}^* - A_{ji}^*)$

Applying Axiom 4 to Axiom 5 we get Theorem 1:

Theorem 1: Decision makers in nation y_i choose foreign policy actions according to the rule:

$$\min (C_{ij}^* - F_{ij}^*) - (C_{ji}^* - F_{ji}^*)$$

And by applying Axiom 3 to Theorem 1 we can get Theorem 2.

Theorem 2: Decision makers in nation y_i choose foreign policy actions according to the rule: \min

$$\{[(\langle Y_{ij} \rangle \cdot \langle C_{ij} \rangle) - (\langle \lambda_{ij} \rangle \cdot \langle F_{ij} \rangle)] - [(\langle Y_{ji} \rangle \cdot \langle C_{ji} \rangle) - (\langle \lambda_{ji} \rangle \cdot \langle F_{ji} \rangle)]\}$$

And by applying Axiom 4* to Axiom 5 we get the much more manageable statement of the substance of Theorem 2.

Theorem 3: Decision makers in nation y_i choose foreign policy actions according to the rule:

$$\min \pi_{ij} R_{ij} - \pi_{ij} S_{ji}$$

where S_{ji} indicates the behavior input to nation y_i from nation y_j .

At its limit Theorem 3 reduces to

$$0 = \pi_{ij} R_{ij} - \pi_{ij} S_{ji}$$

Or

$$\pi_{ij} R_{ij} = \pi_{ij} S_{ji}$$

What the theorem implies is that nations are attempting to match

foreign policy outputs to inputs. The matching is done with respect to the perceived importance of conflictual and cooperative acts and varies from actor to actor for each object nation.

The other implication of the Theorem derives from the fact that we have one equation with more than one unknown (indeed, the number of unknowns is unknown, since it can vary with the number of behavior categories which one chooses to employ). The system of equations is therefore undetermined and indeterminate. There is an infinity of possible solutions. To indicate the kind of problem this is, a nation could reduce the inconsistency created by a more conflictual partner by either increasing its own conflict output or by leaving the conflict output constant and decreasing its cooperative output, or by adopting some hybrid of these strategies. What this means is that we cannot expect to be able to predict what kind of strategy a set of decision makers will adopt in order to meet the rule. We can only predict that they will adopt some strategy which will enable them to meet the requirements of the rule.

What has been developed above would not be an unreasonable place to stop if one were studying a simple two-nation international system. However, the system within which foreign policy decisions are made contains many nations. It seems fruitful, then, to go on and look for the implications of such a multimember system for the general validity of Theorem 3. We shall begin by looking at triadic interactions. A triad shall be considered as a set of six directed dyads composed of three entities such that each entity is the actor in two directed dyads and the target in two. This can be

formally posited as follows:

Definition 9: A triad $Tr_{hij} = \langle x_{ij} \rangle \cap \langle x_{ji} \rangle \cap \langle x_{ih} \rangle \cap \langle x_{hi} \rangle \cap \langle x_{jh} \rangle \cap \langle x_{hj} \rangle$

An illustration of a triad is presented in figure 3.

Once again we have too much information to be handled effectively, so we wish to reduce it. We therefore call on the analytic steps carried out before in Definition 5 and Axioms 3 and 4 to modify definition 9.

Definition 9*: A triad $Tr_{hij} = A_{ij}^* \cap A_{ji}^* \cap A_{ih}^* \cap A_{hi}^* \cap A_{jh}^* \cap A_{hj}^*$

This definition gives us a triad defined by six scalars, two each for each pair of entities. We wish to reduce it further, and therefore modify the definition as follows:

Definition 9**: A triad $Tr_{hij} = B_{ij} \cap B_{ih} \cap B_{hj}$
 where $B_{ij} = \min(A_{ij}^*, A_{ji}^*)$
 $B_{ih} = \min(A_{ih}^*, A_{hi}^*)$
 $B_{hj} = \min(A_{hj}^*, A_{jh}^*)$

In other words, the symmetric dyadic interactions can be represented as equal to the most conflictual directed dyadic link if at least one of these links is conflictual or as the least cooperative if neither is on balance conflictual.

We are now nearly in a position to make some statements of a substantive nature concerning the impact of triads on dyadic interactions. But before this can be done we must define a concept, triadic consistency. Before that can be done we need to introduce some additional notation. The next two definitions carry out both these tasks.

Definition 10: We shall refer to B_{ij} as \bar{B}_{ij} if and only if neither of the dyadic links is on balance conflictual, that is, if (A_{ij}^*, A_{ji}^*) . We shall refer to B_{ij} as \bar{B}_{ij} if there is at least one directed dyadic link which is on balance conflictual, that is, if $(\bar{A}_{ij}^*, A_{ji}^*)$ or $(A_{ij}^*, \bar{A}_{ji}^*)$ or $(\bar{A}_{ij}^*, \bar{A}_{ji}^*)$

So what we have done above is to reduce the information about the pair of dyads in each symmetric dyad in a triad to a dichotomy.

Definition 11: A triad may be said to be strongly inconsistent if and only if there are one or three \bar{B}_{ij} links. A triad may be said to be consistent if and only if $B_{ij} = B_{ih} = B_{jh}$. All other cases are said to be weakly inconsistent.

However, this definition does not meet the needs which we have. Rather, we need a functional definition which will produce an interval scale measure of the degree of triadic inconsistency. Furthermore, we want the function to rank order different inconsistencies, both weak and strong, and to weight the strong more heavily than the weak inconsistencies. The function must also produce a value of zero when the triad is consistent. Formally, we posit

Definition 12: $I_{hij} = f(B_{ij}, B_{ih}, B_{jh})$

We are not able to state at this time the nature of this function. Clearly it will be a complex mathematical operation. The job of discovering it will remain for future research efforts.

We turn now to the problem of assessing the impact of triadic inconsistency on foreign policy. As stated in the introduction, it seems to us that triadic patterns would have a significant impact on decision-making. The reason is that the actions of third parties can have a significant impact on the capacity of a nation to achieve its goals in relation to a target in a dyad. Clearly the actions of the Soviet Union and China have a tremendous potential for breaking the Vietnam policy of President Nixon, and this explains in some sense why it is that he pays so much attention to their actions in reference to Vietnam. This sort of relationship is posited to be a factor in foreign policy making.

Axiom 6: National decision-makers perceive third party behavior as a relevant factor in the achievement of policy goals.

Now, then, is this perceived policy relevance translated into behavior. This is not ground untread by previous observers. Harary (1961) presented the concept of balance in a system. That concept was isomorphic with our concept of consistency in a triad. In reference to unbalanced systems (i.e., strongly inconsistent triads), he argued that the behavior of nations would change to bring the system back into balance. The reason for this was the rule that a friend of my friend is my friend, a friend of my enemy is my enemy, an enemy of my enemy is my friend, and an enemy

of my friend is my enemy. This seems plausible and we wish to have such a position in our theory. But we also want to exploit the characteristics of weakly inconsistent triads, because we feel that they also have an impact on the behavior pattern in a dyad. As an illustrative example, the United States periodically pressures the West European nations to contribute more in development assistance for the underdeveloped nations of the world. These cases could be interpreted as an instance of the United States attempting to reduce triadic inconsistency created by the undercooperation of the West European nations. We therefore posit the following relationship:

Axiom 7: National decision-makers choose foreign policy acts to reduce triadic inconsistency.

So far we have presented a language for talking about dyadic patterns of interaction and some composition rules for talking about triadic patterns of behavior. So far, however, in analyzing the rules of behavior at each level we have ignored the rules operative in the other level. We shall now attempt to fill that void by looking at the interaction between the rules of dyadic behavior. This is done in the following four theorems.

Theorem 4: It is possible to have all consistent dyads in an inconsistent triad.

Theorem 5: It is possible to have all inconsistent dyads in a consistent triad.

Theorem 6: It is possible to reduce dyadic inconsistency without affecting triadic inconsistency.

Theorem 7: It is not possible for a nation to choose actions which will reduce triadic inconsistency

without having some effect on
dyadic inconsistency.

No attempt will be made to prove Theorems 4-6 at this time since they are not germane to the latter part of the paper. A proof of Theorem 7 will be provided, however, since this is the theorem which generates our prediction of an impact of third parties on dyadic relations.

The proof consists of a demonstration that no valid counter-example can exist. Suppose that a nation y_i had foreign policy outputs at time t such that $(A_{ij}^*)_t$. Assume that $(A_{ij}^*)_t$ was more conflictual than $(A_{ji}^*)_t$. Suppose that this generated dyadic inconsistency $U_t = (A_{ij}^*)_t - (A_{ji}^*)_t$ and triadic inconsistency $(I_{hij})_t = V_t$. Assume that all other relevant nations maintain the same behavior outputs from time t to time $t+1$. Assume further that γ_{ij} and λ_{ij} can change only very slowly over time and therefore are effectively constant over two time periods. The problem is, given these conditions, is it possible to get the result $V_t \neq V_{t+1}$ and $U_t = U_{t+1}$?

If $V_t \neq V_{t+1}$, then it must be the case, by definition 12, that $[f(B_{ij})_t, (B_{ih})_t, (B_{jh})_t] \neq [f(B_{ij})_{t+1}, (B_{ih})_{t+1}, (B_{jh})_{t+1}]$. By definition 9** and by assumption we can deduce that $(B_{ih})_t = (B_{ih})_{t+1}$ and $(B_{jh})_t = (B_{jh})_{t+1}$. Therefore, to get $V_t \neq V_{t+1}$ it must be the case that $(B_{ij})_t \neq (B_{ij})_{t+1}$. Since by assumption $(A_{ji}^*)_t = (A_{ji}^*)_{t+1}$ it must be the case that $(A_{ij}^*)_t \neq (A_{ij}^*)_{t+1}$ for $(B_{ij})_t = (B_{ij})_{t+1}$ to attain.

If $U_t = U_{t+1}$ and $(A_{ji}^*)_t = (A_{ji}^*)_{t+1}$, then it follows that $(A_{ij}^*)_t = (A_{ij}^*)_{t+1}$.

Then to set up a counterexample one would have to show some case where both $(A_{ij}^*)_t = (A_{ij}^*)_{t+1}$ and $(A_{ij}^*)_t \neq (A_{ij}^*)_{t+1}$ obtained. This would require either $(A_{ij}^*)_t \neq (A_{ij}^*)_t$ or $(A_{ij}^*)_{t+1} \neq (A_{ij}^*)_{t+1}$. Since these are absurd results no counterexample can exist and Theorem 7 is proved.

The implication of this theorem is that it is possible and perhaps quite likely that nations must choose between actions which will enhance dyadic consistency but harm triadic consistency, or vice versa, and failure to act, thus harming dyadic consistency and enhancing triadic consistency, or vice versa. The problem then is to provide a rule by which the solution to this dilemma can be predicted.

We begin to attack this problem by defining the concept of saliency. Saliency is to be a measure of the importance of an entity to another entity. Thus saliency is an attribute of an entity in a relationship; that is, y_i is salient to y_j , for example. The concept of saliency is created to exemplify the historical importance of an entity y_i to y_j 's foreign policy. The presumption is that the higher the saliency of an entity to an actor the more will that actor's foreign policy be shaped so as to exert control over the attainment of goals involving that object nation. We now formally define saliency and posit its impact on the interactions of dyadic and triadic consistency considerations.

Definition 13: Saliency of a nation y_j to y_i is a function of the amount of across-time

interactions y_j has had with y_i , or

$$P_{ji} = [f(\sum_{t=1}^1 \langle x_{ij} \rangle t)]$$

Axiom 8: The saliency of an entity for a nation determines the policy relevance of that entity for the nation.

We can now posit the completed theory in a single theorem:

Theorem 8: $x_{ij} = f(\pi_i R_{ij} - \pi_i S_{ji}) + \epsilon P_h I_a$

where f minimizes the value of the right side hand of the equation, I_a is the inconsistency of a triad a where both y_i and y_j are members of the triad, and P_h is saliency of the third party in the triad. I_a

What has been presented above is a most general theory.

As stated, it is incapable of supporting empirical matter. Before that can be done, the functions need to be defined and the key variables operationalized. Then the specific formulation of the theory can be tested and accepted or rejected. We turn now to fulfilling that job.

The Creon data source provides ample opportunity for operationalizing our concepts. That collection consists of information collected on the exchanges (foreign policy events) between 35 nations. The time frame is 1959 to 1968. Three month quarters (three consecutive months) were sampled at random from each of the 10 years. This provides ten, three contiguous month data subsets or 30 months of non contiguous data. This data enables us to create the $Y \times Y \times X$ data cube. The $Y \times Y$ matrix will have rows and columns equal to the number

of nations in the international system at any point in time. From this we choose subsets of actors and objects for analysis. The behaviors along the A mode will be represented by an eight variable characterization of behavior. These variables begin with participation and progress along a continuum of increasing commitment of resources with the eight variable being military conflict. Table I presents the variable list.

The problem now becomes representing theorem 3:

$$\text{Min} (\pi_i R_{ij} - \pi_i S_{ji}) \quad (1)$$

or

$$\text{Min} (\pi_j R_{ji} - \pi_j S_{ij}). \quad (2)$$

Now set both (1) and (2) equal to zero:

$$0 = \pi_i R_{ij} - \pi_i S_{ji}$$

$$0 = \pi_j R_{ji} - \pi_j S_{ij}.$$

Now we have simultaneous equations for Y_i to Y_j and Y_j to Y_i behavior. It is argued that both nations attempt to match inputs to outputs in terms of their interpretation of inputs and outputs. In order to solve for the equation we need to make an assumption: Each nation perceives the other's behavior in the same way. This means.

$$\pi_i S_{ji} = \pi_j S_{ij}$$

This is a simple extension of the mirror image phenomenon.

There it is agreed that each nation sees its own actions as good and both interpret the other's actions as bad (Stagner (1967) Bronfenbrenner (1961)). Thus nation, i, places the same

interpretation on j's behavior as j places on his behavior.

From this assumption it is easy to show that

$$\pi_i R_{ij} = \pi_j R_{ji}$$

Setting R_{ij} and R_{ji} in matrix form to represent repeated variable observations of behavior we have two matrixes each 30 months by eight behavioral variables. When we do this we have

$$R_N \times M \pi_M \times M = R_N^* \times M \pi_M^* \times M \text{ and}$$

$$\text{Where } R\pi = A^* \text{ and } R\pi^* = A_{ji}^*$$

A_{ij}^* and A_{ji}^* are now matrices. In other words there are multiple behavioral strategies which occur over time for each nation's dyadic relationships. Placing restrictions upon A_{ij}^* and A_{ji}^* :

$$\{ A_{ijk} A_{jig} = \begin{matrix} k_{kg}, k=g \\ 0, k \neq g \end{matrix} \}$$

$$A_{ijk} A_{ijk} = A_{jik} A_{jik} = 1 \text{ and}$$

$$A_{ijk} A_{ijg} = A_{jik} A_{jig} = 0, k \neq g.$$

These restrictions are synonymous with assumptions in the canonical model and allow its application. The research question now becomes, can we find patterns in both matrices of behavior that are highly correlated? When canonical analysis is employed with these two matrices, it delineates linear combinations from both matrices $\pi_i R_{ij}$ and $\pi_j R_{ji}$, such that the patterns are maximally correlated. At the same time each matched (or correlated pair) are uncorrelated with any other sets delineated in either matrix. The coefficients, π , are interpretable as the evaluation weights each side places upon events they send to the object in

order to minimize the difference between input and output. They can be interpreted both as a preference to respond to certain combinations of events received with specific combinations of events or as the underlying perceptual attempt to reciprocate in kind.

Findings

In analyzing this set of assumptions four nations were chosen: The Soviet Union, the United States, the Chinese Peoples Republic, and Japan. These four nations form twelve dyads. Six canonical analyses were performed, one for each of the linkages:

USR - USA

USR - CPR

USR - JPN

USA - CPR

USA - JPN

CPR - JPN

Tables II through VII present the results. The trace correlation delineates the general overlap between the matrices of behavior sent from each side of the dyad. In general these point out a good deal of overlap. The range of the traces is from .43 for USR - JPN interactions to .67 for USR- CPR exchanges. The reciprocity phenomena explains from 18 to 45 percent of the total relationships in these twelve dyads. There are sub sets of exchanges in each linked pair of dyads which are indicative of much stronger linkages. These subsets of exchanges are inter-related as high as .96 or a reciprocity in

overtime variations of behavioral exchanges of 92 percent. It is worth reviewing some of these linkages. In Chinese-Soviet relations it appears that the Soviets prefer to respond to Chinese offensive verbal conflict with verbal conflict but to keep this activity independent of other exchanges. Both parties seem to recognize a need for a strategy of neutral maintenance of relations which is independent of other strategies. This point is highlighted in the second variate pair. The third variate pair points to the suggestion that the Soviet Union is likely to introduce verbal conflict into procedural matrices but that the Chinese are quite sensitive to conflict mixed with procedural concerns. This would suggest that the CPR wants to isolate the verbal tirades so frequently assumed to be a characteristic of Chinese foreign policy from evidently quite meaningful attempts at negotiation. It also points to the possibility that in the Sino-Soviet relations it is the Chinese which recognize this fact more than the Soviets.

Turning to the US-Chinese relationships it appears that this dyadic exchange also highlights the independence of procedural activities of diplomacy and participation from the more evaluative kinds of actions. The first variate shows that US diplomatic activity towards the Chinese is reciprocated by procedural responses. On the other hand, independent of pattern maintenance activities US cooperative initiatives towards the Chinese tend to be rejected by the Chinese while US verbal

conflictual activities seem primarily to be ignored on the part of the Chinese. Thus, while it would appear that the Chinese are willing to reciprocate on procedural and diplomatic matters, they are unwilling to demonstrate cooperative reciprocity at this stage in US Chinese relations. On the other hand, they choose to ignore or to respond in non-routine fashions to US accusations and complaints rather than to reciprocate in kind or in a way which might escalate the conflictual initiatives on the part of the United States. It may be worth pointing out an interesting difference between Sino-Soviet and Sino-US exchanges. In the Sino-Soviet case, both sides hurl accusations and denouncements at each other while in the case of US-Chinese relationships, China seems to play the part of an unresponsive sparring partner and a unwilling lover.

Chinese relations with the Japanese point to a mixing of cooperation and conflict. The second variate suggests that the Chinese combine verbal cooperation with cooperative actions while at the same time rattling the sabre by using non-military conflict sanctions. The Japanese response is to highlight verbal conflict but to intermix verbal cooperative statements as well. This points to an inability to differentiate between conflict and cooperation strategies in the relations between the Japanese and the Chinese. When the Japanese choose overtly cooperative acts the Chinese do not respond in any reciprocal manner. These complex patterns may well indicate that Sino-

Japanese relations are embedded with a mixture of competition and comraderie. Certainly philosophical discussions of each others role in Asia would lay credence to this suggestion. If, however, the Japanese cooperative activity becomes too severe the Chinese back off by choosing not to make a clear response.

Soviet US relations are the most complex of those dealt with in this paper. There appears to be an independent procedural dimension which points to the agreements on both sides to cooperate in pattern maintenance activities independent of their conflicts of interest. In addition to this, however, diplomatic exchanges appear to be infused with a good deal of cooperation as both the Soviets and the United States tend to engage in verbal and cooperative acts during negotiations. During these periods it appears that the United States is more likely to apply the carrot and the stick by using verbal threats and accusations as well as promises and rewards while the Soviets tend to be less likely to infuse this strategy with conflictual verbage. Some diplomatic activity on the part of the Soviets is not reciprocated by the U.S. as pointed out in the third variate pair. On the other hand, the fourth variate may be the most interesting. It tends to suggest that as the United States increases its non-military conflict activity towards the Soviet Union, the Soviets increase their cooperative actions toward the United States and when the United States decreases its non-military conflict sanctions aimed at the Soviets, the

Soviets increase verbal conflictual activity. This would seem to be a deterrent strategy in which as the United States becomes more menacing the Soviets back off, and as the US becomes less menacing the Soviets tend to increase their threatening stances.

Japanese - US relations seem to be identified by cooperative reciprocity. There are, however, some interesting differences in strategy between the US and the Japanese. When cooperative acts are used by the United States they are reciprocated in kind by the Japanese. On the other hand, the Japanese respond with verbal cooperation to US procedural initiatives, but they do not choose cooperative actions in response to our procedural activities. This would suggest that the Japanese use cooperative talk much more freely than other nations but they are equally careful in the use of cooperative actions. On the other hand, in diplomatic bargaining with the United States they are not adverse to using verbal conflict, a strategy which the United States tends to shy away from in their dealings with the Japanese. What this seems to add up to is that when the United States is seriously acting cooperatively to the Japanese, the Japanese respond in kind. When the United States wants to talk about future activities, the Japanese are willing to signal verbal intentions but are not willing to commit themselves to cooperative acts unless the United States is willing to act. If the United States negotiations signal more commitment than their procedural matters, the Japanese will negotiate but they will not refrain from disagreeing with US positions.

Japanese - Soviet relations are quite simple. Cooperative acts on the part of either nation are reciprocated in kind with the Japanese evaluating slightly higher in this cooperative activity. When the Soviets threaten military activity, the Japanese scream. If the Japanese back off, the Soviets tend to reduce the level of conflictual actions. It would appear that the Soviets have a hard line strategy against the Japanese and that, while the Japanese do not like it, they are unwilling or unable to do more than protest.

These analyses point to a good deal of reciprocity in the relations between the four major nations analyzed here. This reciprocity appears to be quite complex. Nations evaluation of their own strategy and other strategies are definitely not simple act for act weighings. The sophistication of both the Chinese in separating verbal tirades from procedural and diplomatic exchanges and the Japanese in appearing to be willing to cooperate, but measuring the use of their cooperative actions carefully shows that there are a number of strategies for reciprocity in this system. This suggests that our minimization axiom is probably correct under the assumptions of the mirror image but the choice of actions used to respond to an object nation are indeed heavily dependent on situational factors. We would argue that consistent evaluation of behavior may be misleading. These results suggest that various acts are evaluated quite differently depending upon the object nation's mix of behaviors.

Turning now to analysis of the triadic impact on these exchanges, canonical analysis presents residual scores for the over

and under response in each of the patterns delineated in Tables II through VII. These residuals can be employed in an examination of the impact of third parties. If the third parties have an effect on the dyadic relations delineated here, then the residuals should be explained by behavior of third nations. Theorem 8 suggests that saliency is an important consideration in the impact of third party actions on dyadic exchanges. We have dichotomized the saliency coefficient into a zero/one case. All third parties are salient if they had exchanges with the actor in ten out of the thirty months in the CREON data. Thus, for each actor, in the twelve dyads delineated by using four major nations - the Soviet Union, the United States, China, and Japan - we have divided all nations in the CREON data deck into salient or non-salient subsets. In the case of the United States to China there would be thirty-three other nations in the sample. Any of those nations which had had more than ten months of exchanges with the United States were placed in the salient to US subset. Any of those nations which had had less than ten months of exchanges with the United States were placed in the non-salient to US subset. Then the residual matrix from the US - Chinese exchanges was compared with the salient and non-salient to the US behavior matrices. In order to do this, for each month all salient third party behavior to the United States was summed to form a single variable. All US behavior to those nations was summed to form a second behavior variable. A

third behavior variable was formed by summing all behaviors from salient to US third parties to the Chinese. And the final variable was formed by aggregating all Chinese behavior to third parties salient to the United States. This provides us with a matrix of four variables and thirty time periods in which the aggregated behavior to and from third parties on the part of both the actor and the object in the reciprocity analysis is formed. This matrix and the residual matrix are then analyzed in canonical analysis and the trace is presented in Table VIII.

Our theoretical development would suggest that the traces in the salient actors should be higher than the traces in the non-salient cases. This appears to be the case in all dyads in which the Chinese were not involved, with one exception. It would appear that nations which do not frequently exchange behaviors with the Chinese are indeed salient in Chinese relations with any of the three other major nations used here in the direct interaction. Thus, the Chinese do weigh as more salient than our measure of salience would tend to suggest third party activities with whom the Chinese interact infrequently. We would suggest that it is likely to be the case that these third parties are developing nations from the third world and that China's relations with other major nations are more sensitive to these exchanges than is the case for other dyadic relationships amongst other major nations. We do not feel that this negates the theory, but rather suggests that our operationalization of salience needs to be redefined. All the traces suggest that third party activity does have an

impact upon dyadic relationships. And this impact must be analyzed more carefully in the future.

In performing this analysis, we began by attempting to lay out our theoretical concerns quite formally. Speaking personally, both authors can attest to the difficult but rewarding nature of specifying relations in a formal sense. We have found this exercise to be an extremely enlightening one. It has led us to question the utility of current statistical procedures in testing some of the substantively exciting theoretical explanations of foreign policy currently in vogue in the research literature. This work has been an attempt to specify the decision-making rules which nations use in dealing with each other on a daily basis. It grows out of research that the senior author began at the University of Hawaii and has continued at Ohio State in connection with the CREON Project and other data sources. What we are about to discuss in terms of shortcomings of analysis in this area certainly apply to previous works of the senior author but they also are found in other's research. There has been quite a lot of analysis attempting to delineate the foreign policy of nations (McClelland, 1961, 1967, 1968; Smoker 1968; Holsti, Brody and North, 1968; Zinnes, 1968; Tanter, 1972; Azar, 1970 Phillips, 1972, Phillips and Crane, 1972). All of these analyses have used aggregations of event or event type data. The problem also arises in those works that have attempted to relate domestic and foreign conflict (Wilkenfeld, 1963; Rummel, 1966; Tanter, 1963).

The problem stems from the fact that the underlying theoretical argument assumes a time frame considerably shorter than the data analysis time frame. This means that theoretical fluctuations are suspected to be occurring more frequently than the time unit in the data aggregated for analysis. Were this difference in aggregation levels to have arisen in aggregations such as cities, states, or countries, we would have been quick to recognize the dangers of an ecological fallacy. It is only infrequently recognized that the ecological fallacy also applies to differences in aggregation of time (Orcutt, Watts and Black, 1968.).

While our analysis here demonstrates that the suggestion of the minimizing differences in behavior under the assumption of the mirror image has not been disproven an infinite number of other strategies for aggregating to the month-time frame could have just as equally produced the monthly aggregations that we have used. We want to make it clear that the substantive findings are not in danger but the explanation for these findings is not clearly supported. More importantly, perhaps even if minimization strategies can be demonstrated to be wrong independently of this analysis, the statistical techniques employed upon aggregations at the monthly period may well demonstrate a statistically acceptable answer. Consider, for instance, two nations, one sending a conflictual act to the other each of the thirty days in a month. The object nation responds only on the 29th day with 30 conflictual

actions. Were this to happen on a number of monthly occasions, there would be a strong correlation over the months analyzed. Yet this seems quite unacceptable as the object nation is not attempting to minimize its behavior. It is ignoring it and then in one swoop giving back everything that it received.

These problems stem from our aggregations. We have used months in this analysis, but more frequently we notice yearly analyses. These latter, we would suggest suffer more seriously when it is shorter time frame fluctuations of the nature suggested here upon which theoretical explanations are based. Since these fluctuations have not been identified, it is impossible to know whether aggregation in longer time frames created the relationship identified or indeed the hypothesized relationship occurs at all in the shorter time frames.

While we have known this problem for some time, it was in dealing with the triadic problem that this issue became more salient for us. How were we to handle third nations? Obviously our theory suggests that when a nation acts, it looks at who had acted recently, decides how salient their actions are for this relationship and chooses either to ignore or to be influenced by third parties' activities. But, we had thirty-three other nations for each actor in our system. We began by wanting to use all thirty-five nations dyadically but this would have created 33×35 or 1155 canonical analyses and we knew that this was simply too much analysis. Therefore we limited our direct dyadic relationships to the four

nations or twelve dyads we employed. But, in order to develop a meaningful third party matrix we were forced to aggregate all third nations into two sets by assuming a zero/one measure of saliency. This implied that all nations' action in the third party matrix were simply lumped together once they were identified as being salient or unsalient to the actor in question. Had we used all eight forms of behavior, we would have had eight times four or thirty-two variables and a considerable over-identification problem. Attempting to get around that problem left us with no other choice than the aggregation that we developed. More importantly, however, the monthly aggregation of data meant that if three dyads exchanged behavior in a pattern similar to that in figure 2 we would assume that two actions A to C, and B to C were important in predicting A to B's behavior. But since A to C, and B to C's behavior came after A to B's behavior it is a logically absurd assumption.

Having gone through elaborate analytic and methodological gyrations it might seem bizarre to call into question what has been done by ourselves and others frequently in the past. Yet this paper is a good example of a growing difficulty in the application of statistical techniques to the study of foreign policy dynamics. The strength of this study may be summarized briefly: a more formal theoretical approach to a substantively well acknowledged problem ; how do nations choose foreign policy actions to cope with other nations?

The problems may be easily stated, as well, due to data constraints, an operational inability to identify concepts. We think this problem has eluded detection because too much emphasis has been placed upon difficulties in data collection and in mistakes found in the application of statistical techniques. We do not want to belittle the difficulties in data collection procedures, but we must point out that disagreements in this area can only be answered by resorting to measurement assumptions embedded in a formal theory (Phillips, 1972). Unfortunately, there are, as yet, too few formal theories for final assessment of most of these problems. As to arguments about the appropriateness of various statistical procedures, much of this debate, when not highlighting errors in technique, is also premature. In complex social systems such as foreign policy dynamics, the structure of a theory cannot in general be derived from statistical analysis of time series data (Brunner (1971), Thorson (1972), Hibbs (1972)). The key is to have a theoretical structure and specified relationships which properly represent that structure before considering analysis! We feel we have accomplished this requirement before we turned to data analysis. But now we find that analysis lacking in some important respects.

The solution is painful, but obvious. We must disaggregate. Unfortunately the sparsity of data for shorter time frames in any of the data collections in the events movement

as well as most national accounts data sets is such that we may find ourselves unable to use normal statistical techniques when our theories seek to explain short run fluctuations.

We at Ohio State believe that there is a need for developing formal models which seek to explain foreign policy dynamics.

We valued immensely the exercise which attempted to lay out explicitly our expectations. We valued it not just because it led us to a deeper understanding of the hazards in analysis but it also has suggested a solution--all computer simulations. Such simulations would produce expected relations delineated in the front of this paper. Upon experimentation with different parameters and adding some randomness to the model, simulations could be developed in such a way to produce exchanges between simulate nations which could be compared with the underlying distribution of actions in the international system.

Perhaps a final argument is worth making. The analysis that we have been performing to date on these data sources has been primarily linear. This has produced expectations of constant responses to behavioral situations in the environment or domestic constraints at home. Thus, once the strategy or relationship is identified, it is assumed to be constant over time. To be sure, many of us have suggested that we would

have to continue analysis on other time frames to ascertain whether these parameters changed, but little published evidence is available that attempts to specify the nature of the change or dynamics in parameters over time is developing. A simulation model can quite easily build adaptation routines into the axioms themselves.³ Then we can begin to place the simulation under various stressing conditions to see whether it reacts in acceptable patterns.

We are not attempting to cast doubt on the whole of quantitative studies in international relations. We are, however, warning that too frequently we attempt to develop explanations which we test on data aggregated at the yearly or decade level and that in many instances this data simply does not allow us to reach conclusions about the accuracy of our explanations. Solutions to these problems are more easily identified as we begin to develop a generation of formal theoretical systems. The more frequently we see this form of formalization the more easily the difficulties of the nature posed here can be brought to light and solutions developed to deal with the problems.

Figure 1: The International System

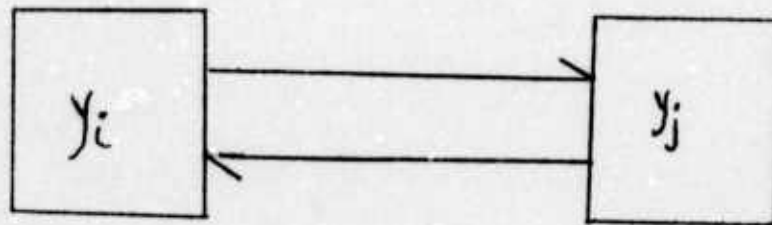


Figure 2

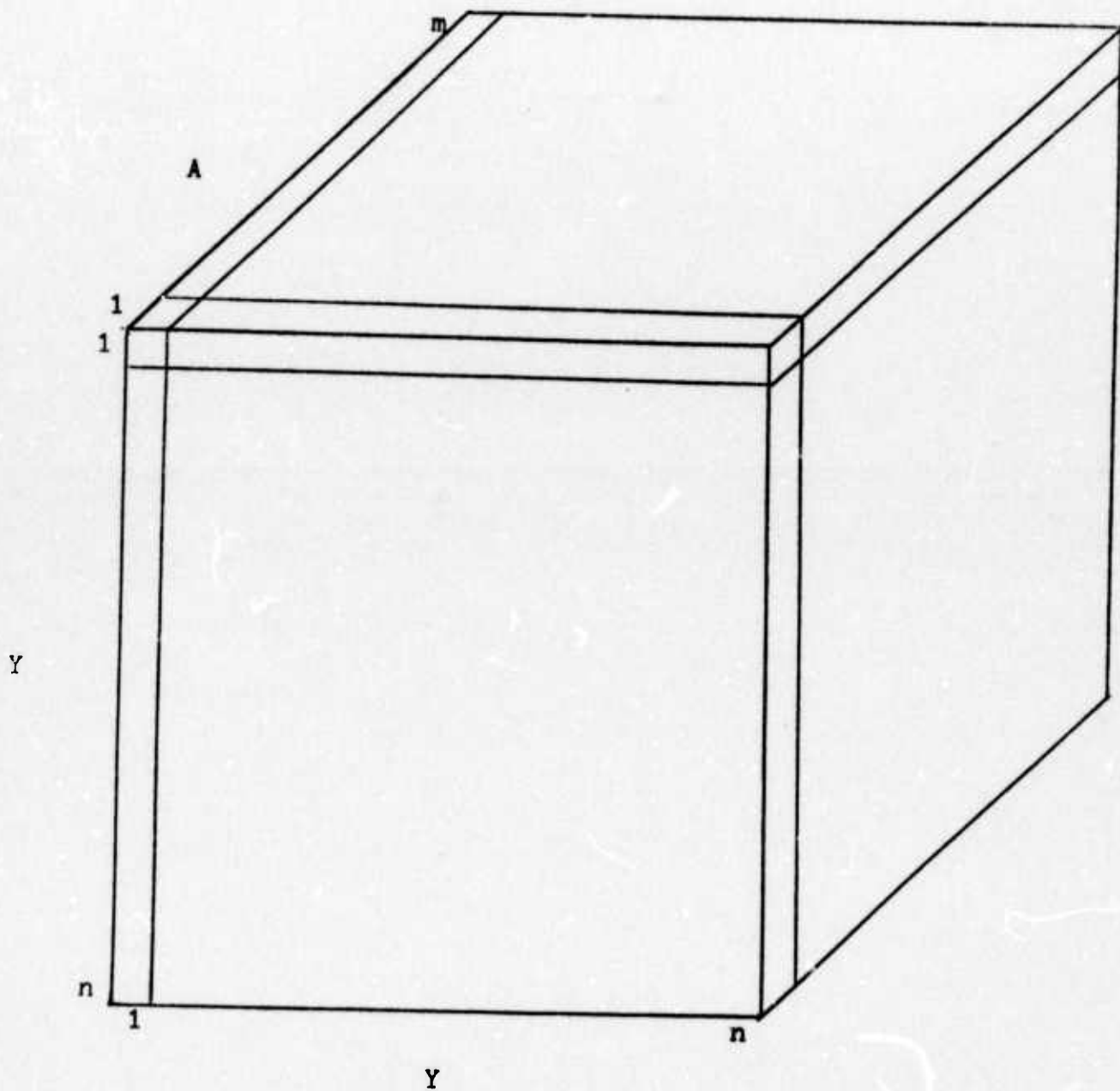


Figure 3: A Triad

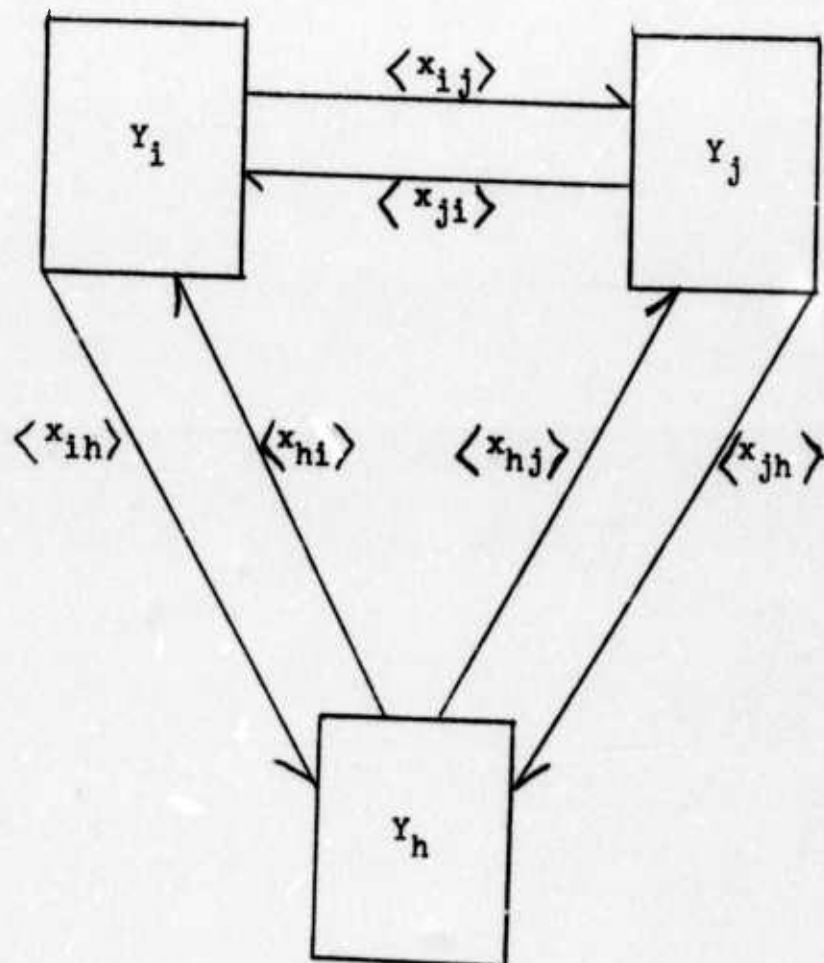
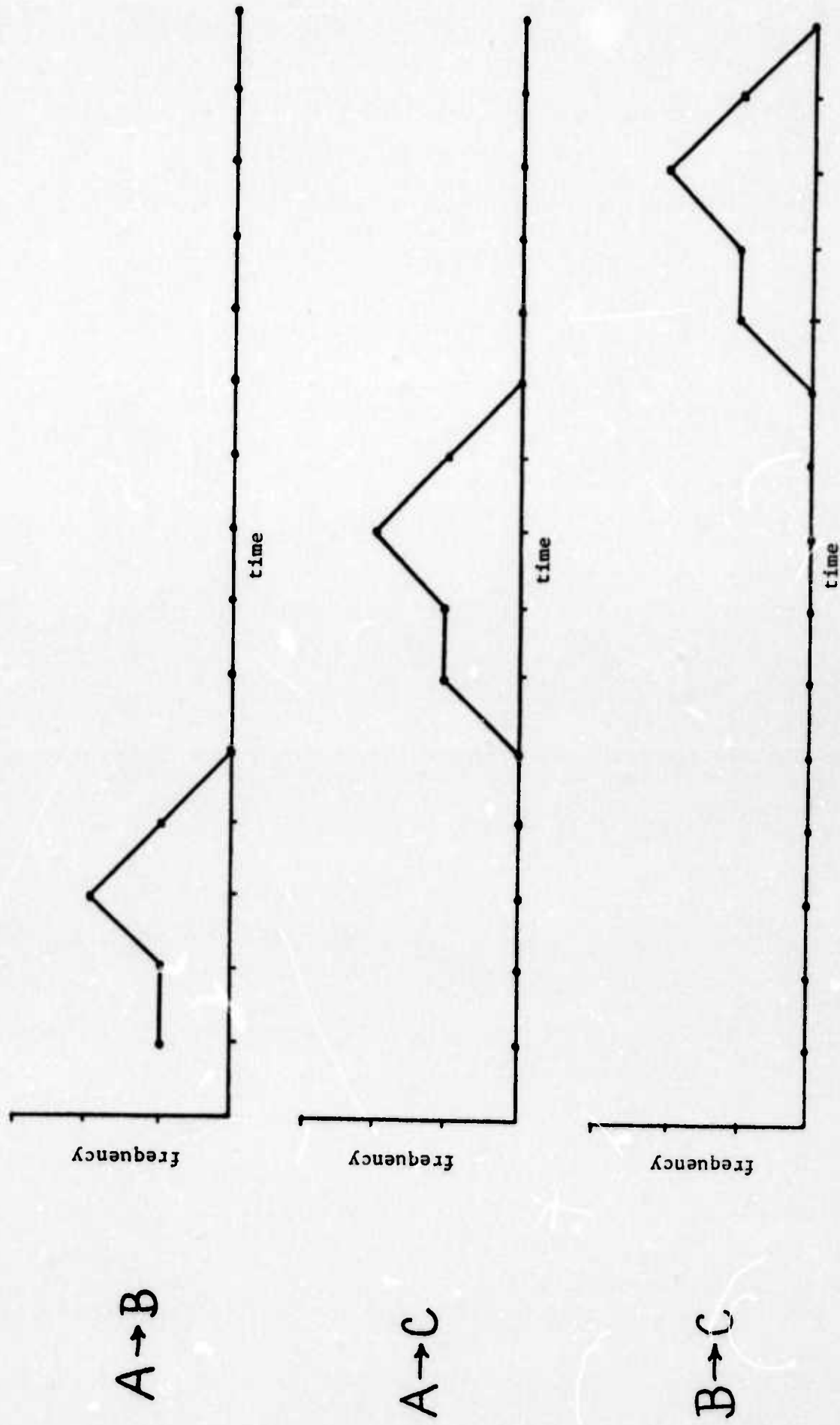


Figure 4



An example of the Sequencing of Behavior in three dyads.

Table 1

Eight Behavioral Variables Used

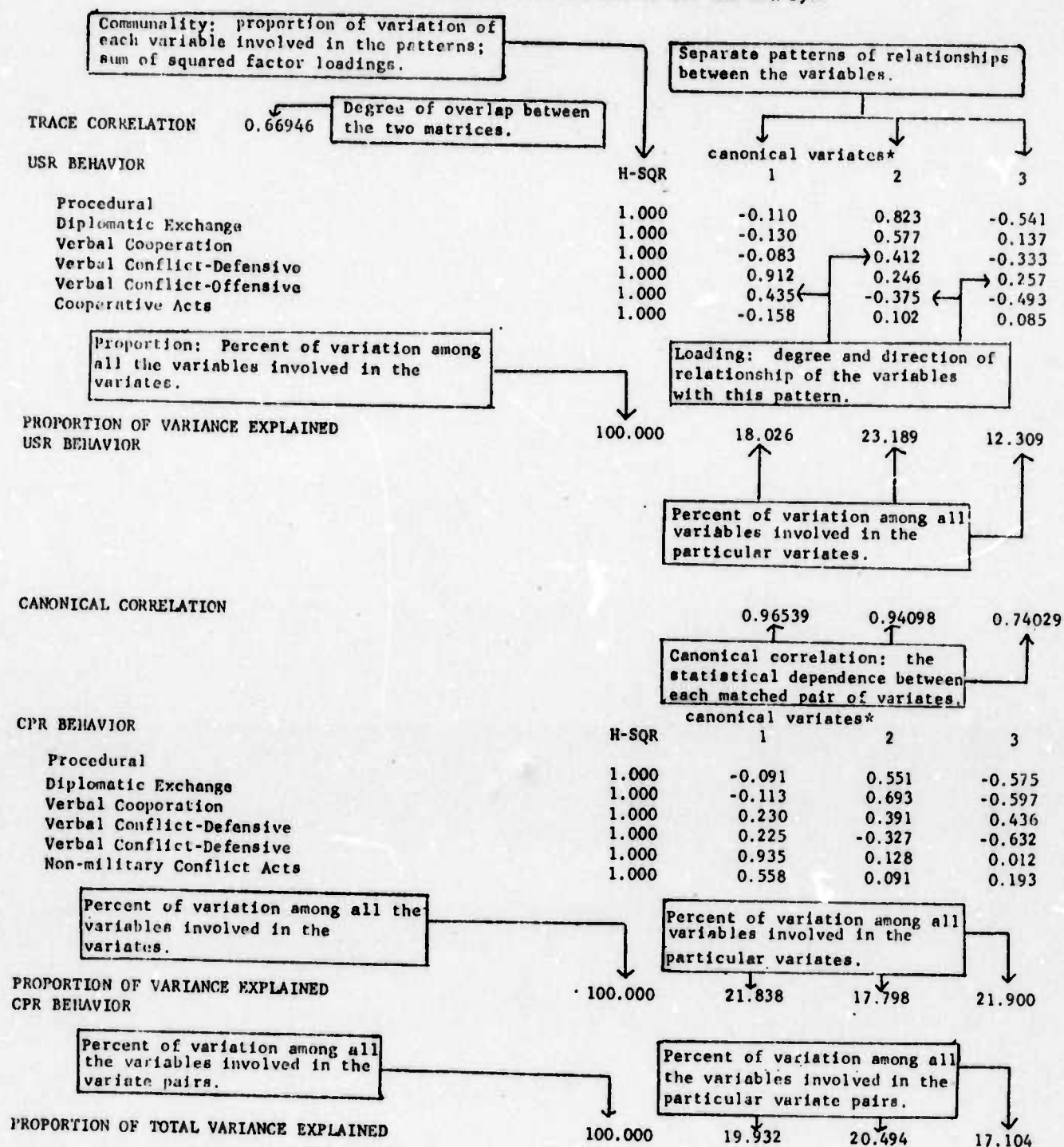
The eight behavior types (behavioral variables) used in this study are derived from the Sequential Action Scheme of the CREON codebook.

	<u>Variable Number and Name</u>	<u>Definition</u>
b ₁	PARTICIPATION	All "Procedural" statements
b ₂	DIPLOMATIC EXCHANGE	All "Evaluative" except "Procedural" statements
b ₃	VERBAL COOPERATION	All "Desire" and "Intent" except "Procedural" which are seen as "Desired" or "Neutral" by Actor
b ₄	VERBAL CONFLICT-DEFENSIVE	All "Elicited" "Desire" and "Intent" except "Procedural" seen as "Undesired" by Actor
b ₅	VERBAL CONFLICT-OFFENSIVE	All "Unelicited" "Desire" and "Intent" except "Procedural" seen as "Undesired" by Actor
b ₆	COOPERATIVE ACTION	All "Deeds" seen as "Desired" by Actor
b ₇	NON-MILITARY CONFLICT ACTION	"Symbolic" and "Significant" "Deeds" seen as "Undesired" by Actor
b ₈	MILITARY CONFLICT ACTION	"Military" "Deeds" seen as "Undesired" by Actor

Note: For some of the eight variables there was no behavior of that type exchanged in a given subsample. In such cases, fewer than eight variables were used in the analysis.

Table 2

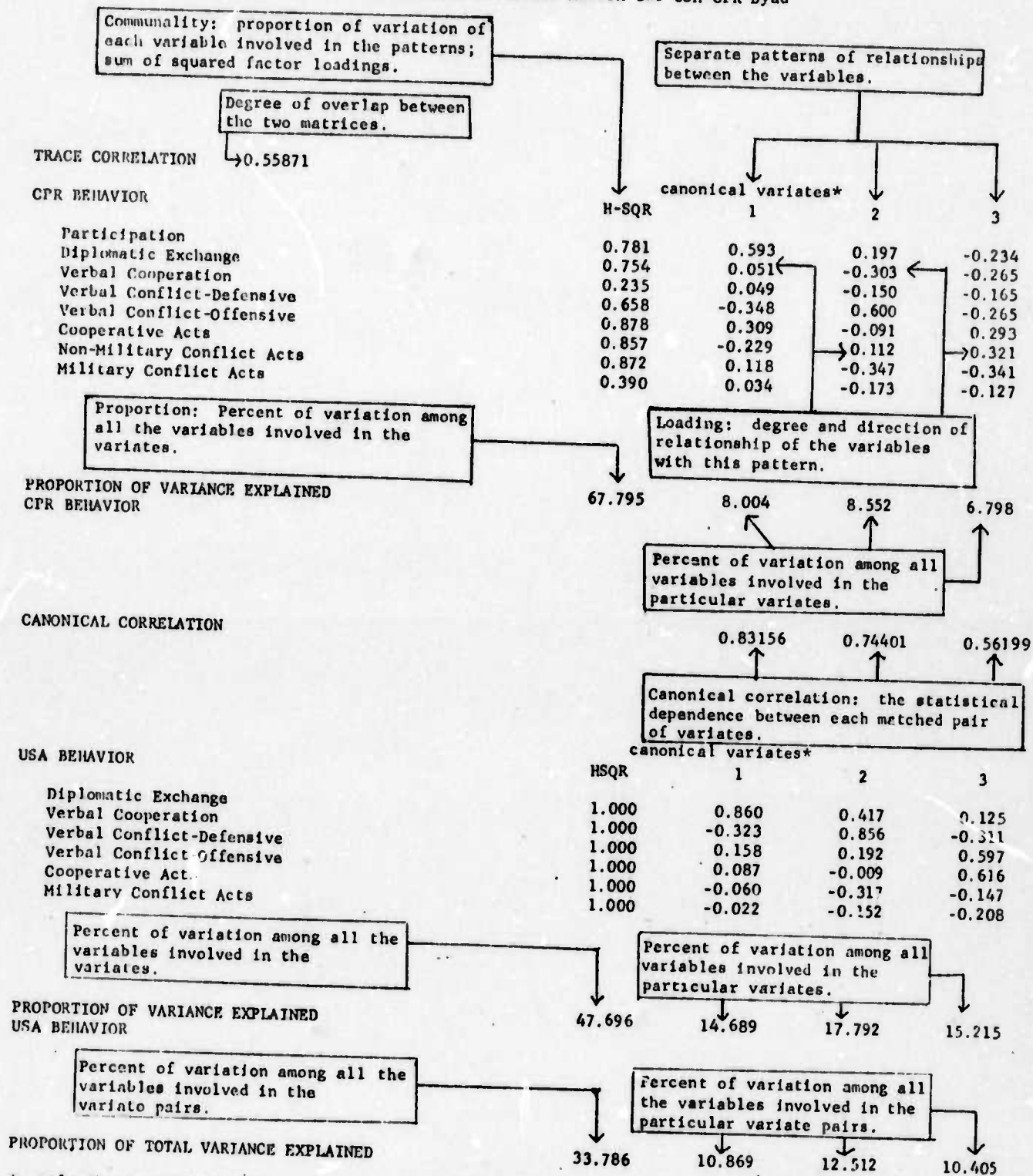
Annotated Canonical Structure Matrix for USSR-CPR Dyad



* Only those variates with canonical correlations greater than .50 are presented.

Table 3

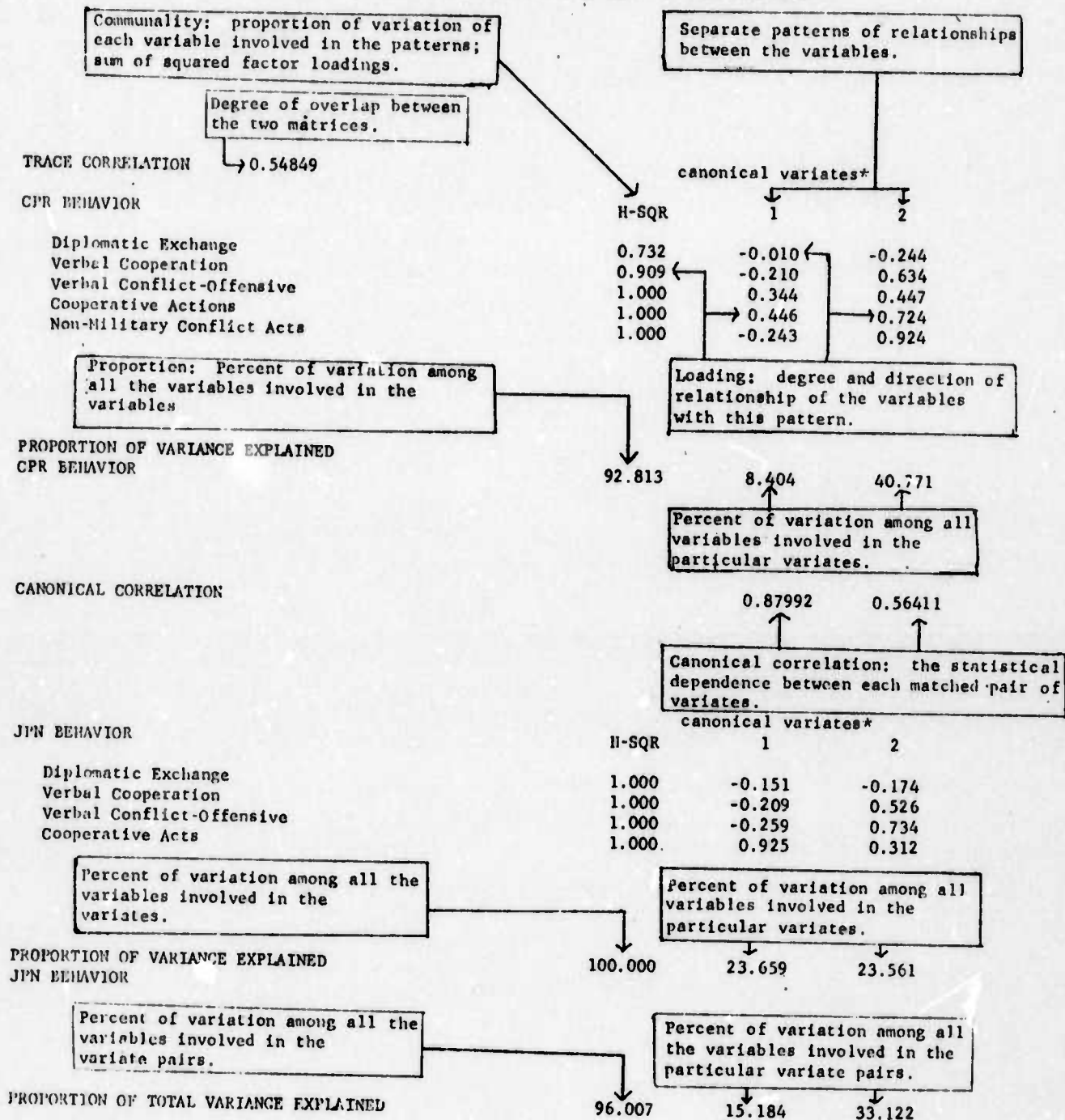
Annotated Canonical Structure Matrix for USA-CPR Dyad



* Only those variates with canonical correlations greater than .50 are presented.

Table 4

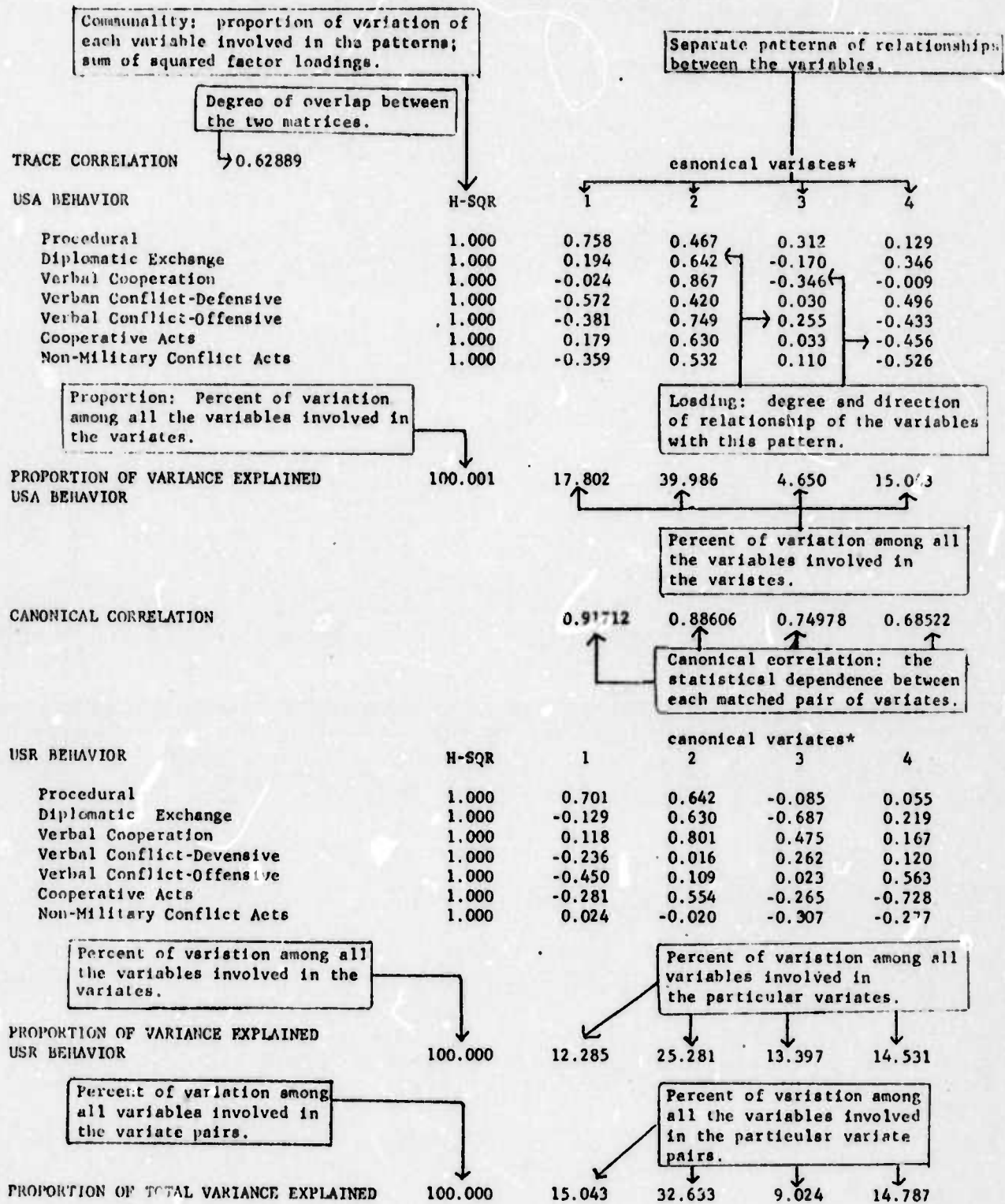
Annotated Canonical Structure Matrix for CPR-JPN Dyad



* Only those variates with canonical correlations greater than .50 are presented.

Table 5

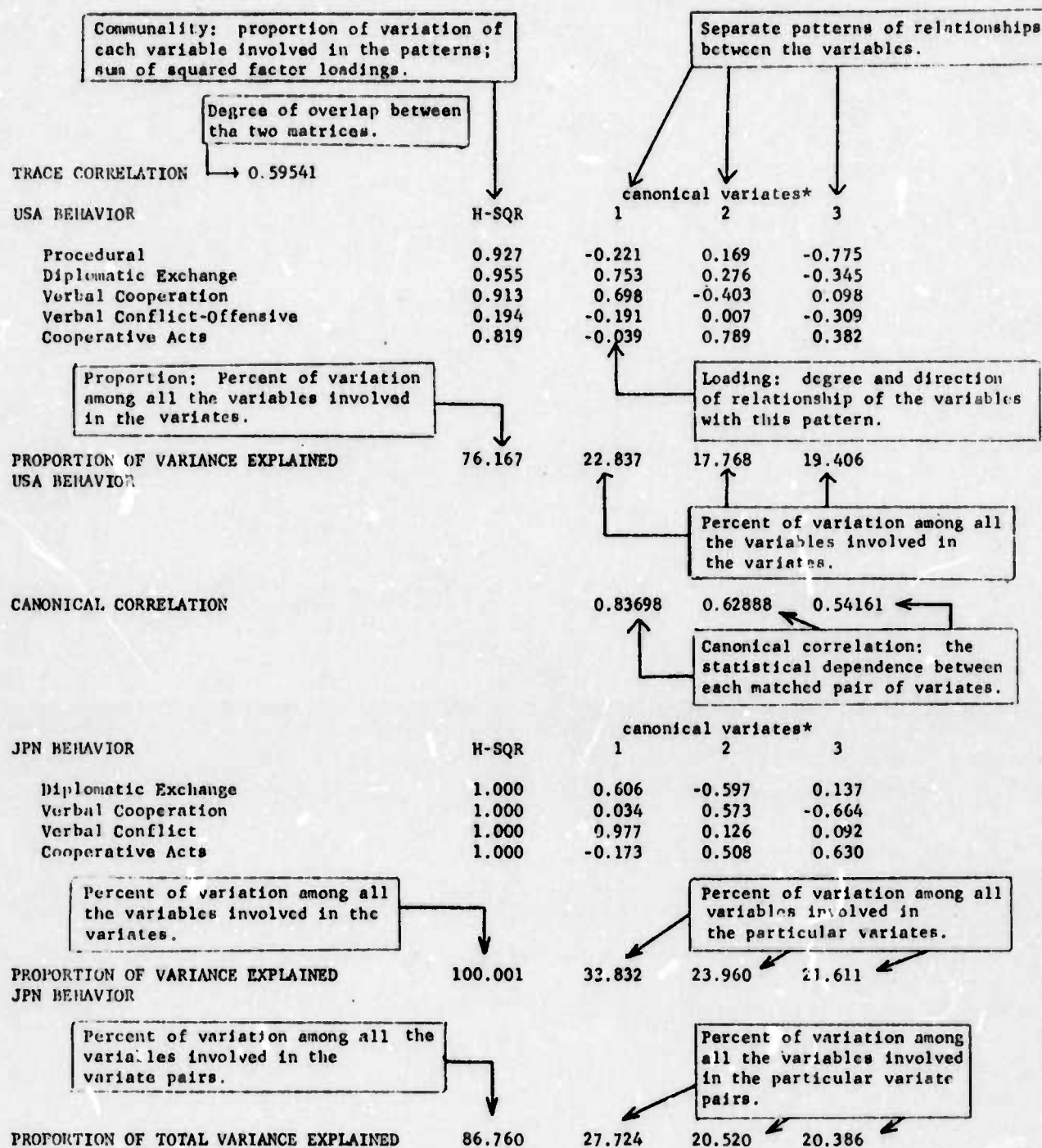
Annotated Canonical Structure Matrix for USA-USR Dyad



* Only those variates with canonical correlations greater than .50 are presented.

Table 6

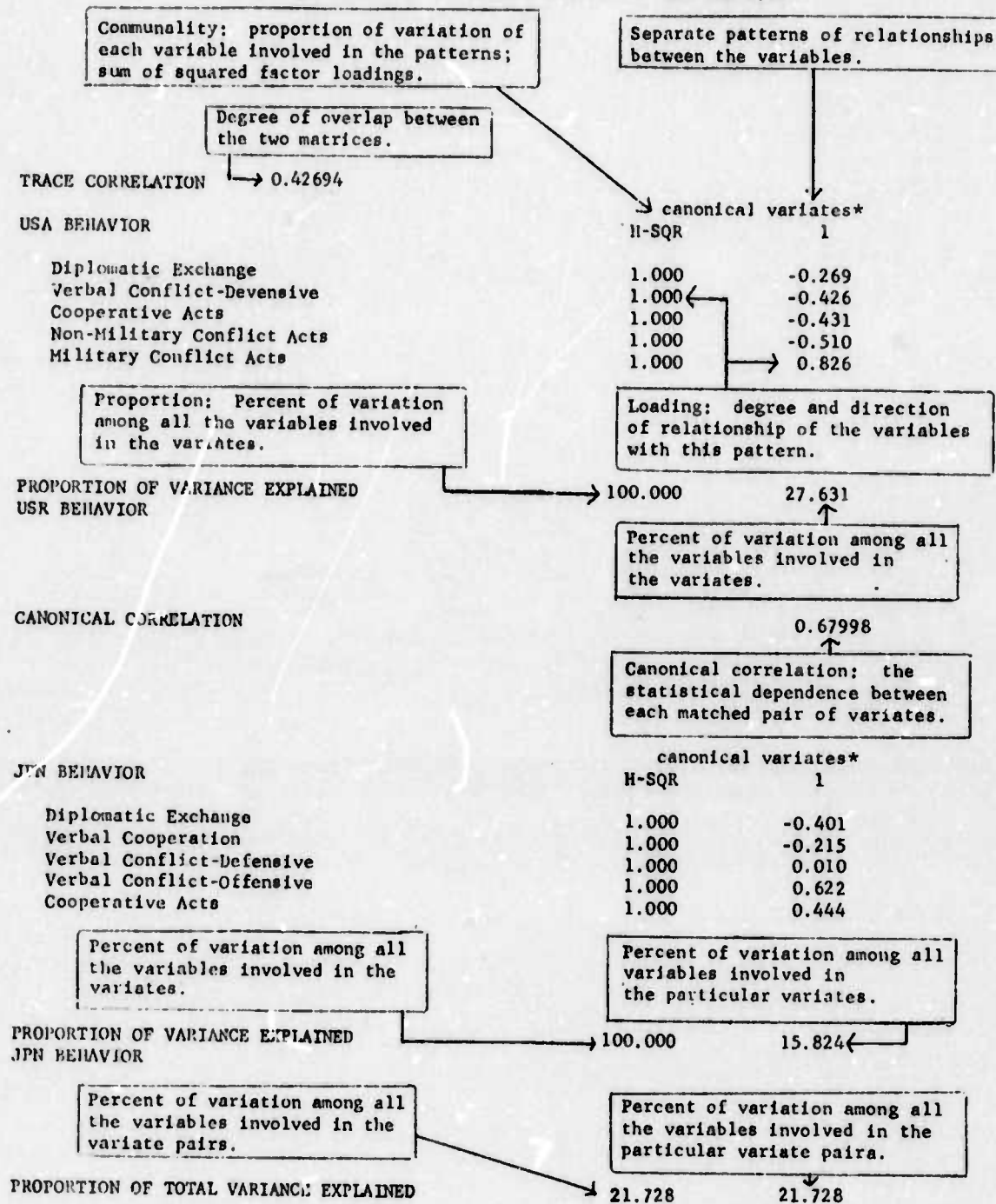
Annotated Canonical Structure Matrix for USA-JPN Dyad



* Only those variates with canonical correlations greater than .50 are presented.

Table 7

Annotated Canonical Structure Matrix for USSR-JPN Dyad



* Only those variates with canonical correlations greater than .50 are presented.

Table 8

Trace Correlation for the Impact of Salient and Non-Salient
Actors Foreign Policy Actions in each Dyad.

	Salient	Non-Salient	Predicted
USA-JPN	.39	.30	Yes
USA-USR	.53	.45	Yes
USR-JPN	.47	.56	No
USR-USA	.49	.47	Yes
JPN-USA	.41	.38	Yes
JPN-USR	.49	.40	Yes
CPR-USA	.47	.47	No
CPR-USR	.39	.52	No
CPR-JPN	.39	.47	No
USA-CPR	.42	.48	No
USR-CPR	.39	.50	No
JPN-CPR	.39	.23	Yes

FOOTNOTES

1. In this paper we will use the following notation:

$\{ \quad \}$ indicates a set

$:$ means "such that"

\in means "is a member of the set . . ."

$\langle \quad \rangle$ indicates a vector

\cup means the union of two sets

\cap means the intersection of two sets

$'$ means the transpose of the vector or matrix

$\langle \quad \rangle_{n \times m}$ means that the vector or matrix
has dimensions
n rows by m columns

\cdot means the inner product of two vectors or
matrices

2. For an extended discussion of **alternative** approaches to the concept of time in social theories, see Rummel (1970) or Smoker (1971).
3. See Rummel & Hall (1969), Lorimor & Phillips (1972), and McClelland (1972).

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